EXHIBIT A

Ram

UNITED STATES BANKRUPTCY COURT
SOUTHERN DISTRICT OF NEW YORK

IN RE:
TRONOX, INCORPORATED, et al., Chapter 11
Debtors. No.09-10156(ALG)
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TRONOX INCORPORATED, TRONOX WORLDWIDE, LLC f/k/a Kerr-McGee Chemical Worldwide LLC, and TRONOX, LLC, f/k/a Kerr-McGee Chemical LLC,
Plaintiffs,
vs. Adversary Proceeding
No. 09-10098(ALG)

ANADARKO PETROLEUM CORPORATION and KERR-McGEE CORPORATION,
Defendants.
----------x
UNITED STATES OF AMERICA,
Plaintiff-Intervenor
vs.
TRONOX, INC., TRONOX WORLDWIDE LLC, TRONOX LLC, KERR-McGEE CORPORATION, and ANADARKO PETROLEUM CORPORATION,

Defendants.
----------x

NEIL M. RAM, Ph.D.
New York, New York
Wednesday, February 8, 2012
Reported by: Steven Neil Cohen, RPR
Job No. 308787

Ram

February 8, 2012

9:05 a.m.

Videotaped Deposition of NEIL M. RAM, Ph.D., taken by Defendants, pursuant to notice, at the offices of Bingham McCutchen, LLP, 399 Park Avenue, New York, New York, before Steven Neil Cohen, a Registered Professional Reporter and Notary Public of the State of New York.

we are here to talk about today, have you ever in the past prepared a cost estimate based on data limited as of a past date?

A. Yes.

Q. Okay. How often?

A. Once before.

Q. Okay. And what was the context of that examination?

A. I had been retained on behalf of Sealed Air to evaluate costs that were projected I believe the year was as of 2002 on behalf of about 32 properties, maybe it was 33, in a portfolio being managed by -- these are W.R. Grace work properties being managed by their internal environmental arm known as Remedium, R-E-M-E-D-I-U-M.

Q. And in that capacity did you provide specific estimates for each of the 32 or so properties?

A. Yes. To the best I can recall.

Q. And then as part of that representation did you also provide a total estimate for the total for all the sites examined?

that Sealed Air case similar to what you did here?

A. There are some differences.

Q. What are the differences?

A. This is -- again I will just caveat it to the best I can recall on everything I subsequently say. I don't believe that report used net present value.

Q. Okay.

A. It was a different date as of 2002.

Q. By the way, was there a specific date?

A. I don't recall the month.

Q. Okay.

A. Also in that report I was asked to opine about the methodologies used by Remedium in projecting their future costs. And I was not asked to do that in this matter so a good part of that involved that evaluation.

A large number of the sites in the Sealed Air matter were vermiculite, a type of asbestos. So -- which is not one of the

contaminants -- well, it is a contaminant concerned at some of the sites but that was really a large focus of that project.

I don't believe I -- I believe for that one I had sufficient information to use site specific costing at all sites. I don't believe I had to use metrics at sites as I did in this matter.

Q. What overall methodology did you use?

A. The -- I used a deterministic methodology. I don't recall if it was -- I believe I provided a range. I don't recall basically most likely value, a range in those but I would have to refresh my memory if there was anything else beyond that.

Let me just think if there is any other differences just for a moment.

But there were Superfund sites in that matter and there was a range in the different types of sites as well in that matter. I just don't recall the specific types of sites.

Q. And when you said there was no net

present value, what did you mean by that?

A. Just, I don't believe in that Grace matter there was any apportionment issues. I am pretty sure although I don't know 100 percent I am pretty sure that Grace had retained 100 percent of the liability. I could be wrong but at least I don't remember that specifically.

I wasn't -- to the extent on that one I basically just provided a single number. I didn't have to project what years those costs would be incurred and then do a net present value back to 2002 as I did in this matter.

Q. When was that work done?

A. I think --

Q. Roughly.

A. I think it was the summer of 2002 to the best I can recall.

Q. How long did that project last?

A. It was a very quick burn. I think I did the whole report in a couple of months during that summer.

Q. Have you submitted a report or

does that in fact include what you characterize as the initial list of documents or information relied upon?

A. Yes. Basically corresponds to the documents that are cited as footnotes in my report.

Q. Okay. And the -- Mr. Zeiger's cover letter indicates that it is a list of documents cited in your report.

Is that accurate or is it -- and let me ask it compound, or is it the list of documents that you relied upon in your report or both?

A. Well, this list is providing the documents that are cited. That doesn't necessarily mean there are additional documents that I read and considered and which had information in it but for whatever reason I didn't actually cite when I wrote my report, the information I presented, I only included a footnote to whatever I wrote about.

Q. I mean -- I don't mean to make a big deal but I just want to make sure that

we are clear about this.

The Federal Rules typically require an expert to list all the information he considered. Is that right?

A. That is my understanding.

Q. Right. In this case I suspect you are aware that the parties stipulated that that need not be done and that the experts only need to cite those documents which they relied upon. Is that your understanding?

A. You are asking kind of a legal question so I will defer to you in terms of what is required under the law.

Q. Here is my question. Is, Mr. Zeiger indicates that the list is, of documents cited in your report and then if you look at the list itself you talk about the list of documents relied upon. And I would like some clarification as to which is it is or both?

A. To the extent I have information that I cite in footnote I relied on, directly relied on that information, so it is refer -- it is both referenced and relied

upon.

One thing that I can think of is my appendix of there is a -- I have an appendix, I think it is D and E of primary documents. I presume that all those documents are included in this list. I haven't actually cross-referenced that but they have been provided as in the report itself.

Q. Okay. So if I understand you correctly one can assume that this list provided on July 14, 2011 and the appendices that you just referred to should encompass all the documents you relied upon in preparing what we have marked as Exhibit 1, your initial report, is that right?

A. Well, to the extent -- I am not sure how to interpret, I just want to make sure I will be 100 percent truthful.

To the extent let's say there were sites that I researched and determined for whatever reason that I was not going to include them in this report so they are not part of the universe of the 372 sites for

which I did costing, it is kind of -- I relied on those documents not to include them in the report. I guess that is the best way to answer it.

Q. So let's focus on the 372. To the extent you relied on a document in rendering opinions on the 372 sites are those documents listed either in Exhibit 2 or in the appendices you just referenced in your earlier answer?

A. They would be but I also want to add because -- I mean this is a huge amount of work preparing this. It is a very thorough evaluation of a lot of sites, I think it represents a total of 38,000 hours total of my team and over 2,000 of my hours between this and the rebuttal report, and dealing with thousands of documents and as best as I could I -- whenever I made a statement that needed a factual citation I included a footnote.

There may be analogous documents that have similar information that I actually looked at and evaluated but didn't

cite so -- but to the extent what is written here has a footnote that I relied on in making that statement they are in that report.

Q. And was it your understanding that you had a duty when submitting this June 24, 2011 report to list all the documents that you relied on in rendering the opinions expressed in that report?

A. And I have done that. I am just -- so anything that is written here, the basis of that, those statements, the documents I actually relied on in writing what I wrote in this report are footnoted and I relied upon them.

MR. LOTTERMAN: Let's mark this as Exhibit 3.

(First errata, July 18, 2011 Table to June 24, 2011 report was marked Roux Exhibit 3 for identification)

BY MR. LOTTERMAN:

Q. Dr. Ram, I have handed what you has been marked as Roux Exhibit Number 3 and ask if you can identify this document for

A. Well, that other topic that I mentioned was to the extent there are other documents with similar information that I reviewed and considered but actually didn't cite there may be additional documents because of the enormous volume of documents in this matter.

However, to the extent I wrote opinions in here and provided a basis and provided a footnote with -- citing the document I used in writing that opinion, that is what I relied on when I wrote this report.

Q. Is your answer suggesting that to the extent you were able, you had two documents which supported one opinion in your initial report, you only cited one of them?

A. I cited -- well, the number of documents is almost beyond comprehension in terms of the number of documents and I have read thousands of documents. I just don't want the record to make it seem like I only read the documents that are cited in the

Kirkland July 14, 2011 regarding my June report. I actually likely read a lot more, not just sites that aren't included but even documents on sites that are included however to the extent I rendered opinions and wrote information in my report I did cite them in this report and relied on those.

Q. I understand you read more documents. I also understand you may have even considered more documents. I want to focus on what you relied upon.

And here is my question. Is, if you wished to establish a specific fact preNovember 2005, let's say the amount of waste at a particular site and you had two documents which gave you that number, estimates or real, whatever, I don't care, two historical documents, did you have a duty to cite both documents in this report?

MR. ZEIGER: Object to the extent it calls for a legal conclusion.

THE WITNESS: I would have cited the document that I felt had the best citeable information that I used in my

if you look at the equations, it occurs at mid year, the expenditures are all expended at mid year.

Q. No. I guess my question is, upon which date do your cash flow analyses assume future costs began?

MR. ZEIGER: Object to the form.

THE WITNESS: The tables all show the first year it occurred is 2006.

BY MR. LOTTERMAN:

Q. Okay.

A. So it would be January 1, 2006.

Q. Would your cash flow analysis change if you used a different date?

A. In terms of my assumption of when future response actions would begin?

Q. Yes.

A. Relative to then calculating the present value as of November 2005?

Q. Yes.

A. Yes, it would change.

Q. For example, if you used November 30, 2005 would you have a different cash flow analysis than the one you

provided?

A. So just so I understand, so if you are asking if I started response actions say on December 1, 2005 instead of January 1, 2005?

Q. Correct.

A. There would be a -- a de minimus change in the numbers.

Q. But there would be a change, correct?

A. Very minor, yes.

Q. Okay. Did anyone at Roux assist you in preparing the cash flow analyses?

A. Preparing the tables that support my costs?

Q. Yes.

A. Yes.

Q. Okay. Did anyone outside of Roux assist you in that process?

A. The tables were prepared with 100 percent under my direction by Roux Associates by my team.

To the best I recall, however, we -- I did provide that to Professor Newton

to see if those tables would suffice relative to what he would need to do in rendering his opinions and he said they were fine.

Q. Okay. Other than Mr. Newton --

A. But he made no changes whatsoever to them.

Q. I understand.

Other than I think it is Dr. Newton -- other than Dr. Newton's input or interaction did anyone else assist you in preparing the cash flow analyses?

A. No.

Q. If you look at that, again that first paragraph in executive summary you -- the sentence continues that, "Tronox likely would incur for environmental sites that Kerr-McGee Corporation or its affiliates or predecessors owned, operated and/or used for waste disposal."

Do you see that?

A. Yes.

Q. I want to focus on the phrase "affiliates or predecessors."

November 30, 2005?

A. I did.

Q. Any input from counsel?

A. Tony Ellington in one matter, the Jericho site.

Q. Any others?

A. Tronox personnel, not counsel.

Q. What I am wondering is as far as -- is what those terms mean and where that line should or should not be drawn did you seek any advice or counsel from anyone, legal or otherwise, as to where that falls?

A. Only Tony Ellington and Tronox project -- former Tronox project managers.

Q. Have you ever had to make that call before on any other projects?

A. Sealed Air.

Q. Okay. There was a known or knowable --

A. I believe that one just said "known." I believe I did not use the word "known" or "knowable."

That doesn't necessarily mean I didn't use the same screening criteria in

terms of what information I used but I don't think I used the word "knowable" in the Sealed Air project.

Q. What were the screening criteria you used?

A. So with respect to known, that is pretty much a site document dated on or before November 30 that contained information and therefore it was known.

With respect to knowable information it was all of the first category plus anything -- any information that could have been determined as of November 30 if someone bothered to look for it.

Q. Okay. So let's pursue a hypothetical. If in your mind there is a canister of some contaminant sitting in a field owned by Kerr-McGee and as far as you know no one living was aware that that canister was there. It had been sitting there for 80, 90 years.

Would you consider the fact that that canister -- and you then went after the fact or after once hired walked the site,

saw the canister, sniffed it, realized what it was, do you believe that fact is knowable for purposes of this cost estimation?

A. If a tree falls in the woods and no one is there to hear it did it still fall. Yes, it did still fall.

If the canister existed in November 30, 2005 and site conditions had not changed, so -- you know things could grow over or it could have been cleared, you know, to the extent that that, an observation, a great example would be some of the solidified creosote that I observed at several sites, Columbus or my team member Columbus being one in the Green Tie area anyone who would have walked over that site on or before November 30, 2005 who was looking for that would have seen it. You can't really miss it.

So I would consider that knowable even though no one had actually, you know, bothered or taken the time to go look for things that were pretty easy to -- had they wished to understand is the Green Tie area

contaminated with creosote as of November, you know, a 15-minute walk over would have concluded yes, it was, so --

Q. What if that canister is buried three feet underground?

A. I should have clarified. It is really surface, readily -- I am not including, you know, to the best I can recall, I don't believe I included, you know, had they put in ten wells they would have found contamination although I quite honestly, as of 2005 undisclosed wood treater sites, same operations, pretty much knowable there is going to be creosote in the subsurface because they all have them although it would have to be verified with the well. That is kind of the next layer of knowable that I don't believe I have to -- I went back to that level of interpretation.

Q. Would you consider a sort -- I am sorry.

A. Another example would be two times background gamma readings in the Lukachuka Mountains, very easily just walk over with a

gamma meter, not a -- it is not a difficult process, plus you know the material is radioactive because that is what it is, it is waste rock, and, to -- for me -- I think for me not to -- not to -- to -- for me to have concluded in the case of Lukachuka, I am doing this by way of example, that was not knowable because the screen reports came after 2005, I think that type of information certainly was knowable in 2005.

Q. What if the canister is sitting on the surface but you have no idea what is in it, is that knowable?

A. It is knowable that it is a canister. If it is labeled you might even know what it is in it.

Q. But absent that would you consider -- let's say there is contamination in it but you can't tell by the canister itself and walking by you have no idea if it is full of saltwater or a contaminant, would you view that fact as knowable for purposes of this cost estimation?

MR. ZEIGER: Object to the form.

Ram

THE WITNESS: Well, if it is knowable that it is a canister. If the site operations indicated that toxic gases were manufactured at that site then there would be a high likelihood that would be a residual cylinder that was used for that operation.

So for safety purposes, for instance, I would assume it was. I would not just pick it up. I would have a health and safety plan that said if you find a cylinder laying at the site where they used to manufacture toxic gas you are not to touch it. You need to hire qualified people who would know how to handle that kind of cylinder.

And in fact I just completed a project in New Jersey where I managed a project that uncovered 1,000 buried cylinders and in fact did hire specialists who assumed that every one of them could be pressurized and could contain a toxic chemical because, in fact, that facility did manufacture

those type of chemicals.

BY MR. LOTTERMAN:

Q. And would you consider a, for example, a soil boring that occurs after November 30, 2005 which indicates that the soil that in fact is uncovered is contaminated, would you consider that a knowable fact?

A. If that is the very first boring -- were there -- I would have to ask a few questions.

Q. It is the only one.

A. It is the only one?

Q. Yes.

A. And what kind of site is it?

Q. You don't know.

A. If I don't know what kind of site it is I -- I -- there is a step being skipped. At a minimum you would have to try to understand what the site had historically been used for.

Like I said before, if it was a former wood treating site and you are standing on ground zero where the retorts

used to be then there likely will be contamination at that location.

Q. What if you are standing on the edge of the property on your example?

A. You wouldn't necessarily know if that area is contaminated.

Q. Not knowable?

A. Not knowable.

Q. If you look at the chart which is -- appears to be part of your paragraph 1 on -- again we are still on page 1, you have two -- three columns actually. One is unlabeled and you have low and high.

Do you see that?

A. Yes.

Q. And then under the first column you have sites included in Schedule 2.5A of the master separation agreement.

Do you see that?

A. Yes.

Q. And then below that you have called undisclosed sites.

Do you see that?

A. Yes.

A. I personally did not. I don't know if they relied on anything. If they had access to my report that they may or may not have. I am not sure.

Q. Are you aware of anyone at Roux who provided them with any information as part of that exercise?

A. No one has provided from my company any direct information to that firm.

Q. Who hired you to undertake this project?

A. I am trying to remember if -- I think I was originally hired directly by Tronox in January of 2009 time frame.

Later that retention shifted to Kirkland & Ellis.

Q. I believe in an earlier answer you mentioned it sounds as if you had added up a number of hours, person hours involved with this project; is that right?

A. Yes. Through the end of January.

Q. When did the project start?

A. I billed my first hour on February 6, 2009.

Ram

recall.

BY MR. LOTTERMAN:

Q. Did you assign, as part of this project did you assign specific Roux employees to specific sites or categories of sites?

A. In general, well, yes. Each Roux team member was assigned specific sites and to the extent I could group them in common portfolios it would be more efficient and have a better outcome.

Q. Who handled the ag-chem sites?

A. Initially a woman who is no longer with Roux Associates, Brigid Milone and then Tom Buggy continued that work.

Q. What about the chemical sites?

A. Different people like -- you are talking about perchlorate?

Q. Yes.

A. Nancy Nevins.

Q. And, again, it doesn't have to be an exhaustive list. In fact, I am more interested in sort of the principal person to tell you the truth but --

A. I am only giving you the principal.

Q. Okay. Right.

A. Just see what other sites might be chemical.

Mitch Weist and actually I should also say for ag-chem, Larry was also involved with one of those, Larry McTiernan. Nathan Eppler, chemical.

Q. What about the thorium sites?

A. Yixian Zheng. Y-I-X-I-A-N Z-H-E-N-G.

Q. Thank you.

What about the mining sites?

A. Larry was involved with those. Brigid Milone was involved with those and I should say I was involved with all of them.

Q. We will get to that.

A. Yes. Very active, you know, I basically managed and directed all of that work.

Q. For every site?

A. For every site.

Q. In every category?

A. In every category.

Q. And you had overall responsibility for those sites and categories?

A. Yes. And every site and category are my opinions based on all of that work.

Q. I understand.

A. Mining? Oh, Tom Buggey also did help with some of the mines as well.

Q. What about nuclear sites?

A. Yixian, Larry, Mitch Weist.

Q. Petroleum site?

A. Do you include Lukachuka as a nuclear site?

Q. Well, tell me who handled Lukachuka.

A. That would be Charlie McDuckin.

Q. How about petroleum sites?

A. Mark Lovejoy. There may have been others as well.

Q. Okay. Service stations?

A. Douglas Swanson.

Q. How about wood treating?

A. Greg Scott. And you are talking about disclosed and undisclosed.

Q. Yes.

A. Brigid Milone, Tom Buggey.

Q. And again, as part of this process, overall process of developing this cost estimate we will talk about today, did you use subcontractors?

A. No.

Q. Did you use any other firms?

A. No. Other than EDR for the database. And the drillers for the two sites.

Q. Any idea what your average fees were per month as part of this process?

A. I think they would range on the low of -- well, they were probably early on they were under 100,000 but they tended typically to be more than $100,000 each month and maybe in some months as much as $400,000, typically around when a report was due.

Q. Any idea what the total fees you have been paid as part of this project?

A. My company?

Q. Yes.

examination to exclude any questions on that.

And this agreement appears to be signed by you on or around February 10, 2009. Is that right?

A. Yes. On behalf of Roux Associates.

Q. And so did this agreement launch this cost estimate project we are talking about today?

A. I wouldn't characterize it that way because as the project ended up in terms of its magnitude and size and complexity it did not start that way.

Q. Okay. But you testified --

A. So I wouldn't say that it launched what is now the project as I sit here today.

Q. You told me earlier that this project began on February 6, 2009, is that right?

A. That is when I first billed the best I can recall.

Q. And was it billed pursuant to this professional services agreement?

A. Yes. Which is dated five days later.

Q. Okay. Did this professional services agreement encompass other work besides preparing this 2005 cost estimate for Tronox?

A. In fact this first agreement did not engage me for preparing any of this work that is sitting here on the table at the moment.

Q. What did it engage you to do?

A. I was first engaged to evaluate I believe it was 11 sites to determine whether the reserves that had been taken for them were appropriate and whether Dennis, I can't remember his last name, sorry, should sign the 10-K.

Q. And what did that project entail?

A. It was a fairly fast project because the presentation I believe I made in May so we had two months, 60 days I guess to go through those sites. And to determine, just trying to remember the year, whether -- whether the reserves for that current year

Q. And this portion of your report estimates the costs for Crest Creek, correct?

A. Yes.

Q. And what kind of site is Crest Creek?

A. It is a river where thorium was essentially discharged for several tens of miles and contaminated sediment along the -- along the creek.

Q. Did you also examine Crest Creek as part of the reserve project that you testified about just a moment ago?

A. Yes.

Q. Did in fact those two efforts overlap?

A. Did the what?

Q. Did the two efforts overlap?

A. Well, they were -- I am not sure what you mean by "overlap." I mean I know what the word means but I am not quite sure what you are asking.

Q. In other words, were you developing cost estimates for the 2005

project at the same time you were examining Tronox's reserves as of 2008?

A. I think at the time and I am a little vague on this but I believe, yes, I was although the major focus of it and what I ultimately presented was based on 2008.

Q. Okay. If you look at this portion of your report, I am looking at the, it looks like, it is really the second major paragraph but technically the third. Do you see where it says, "The reserve for the Crest Creek West Branch to page river site and the STP River OU on Schedule 2.5A as of November 30, 2005 was 77,360,876."

Do you see that?

A. Yes.

Q. Why did you cite that fact in your 2005 future cost estimate for Tronox?

A. Informational.

Q. But you did it for every site, didn't you?

A. It was the formula, the template to have consistency. I didn't use those reserve numbers because it was a whole

Ram

My question is did you provide that information to the board on Exhibit 9?

A. Thank you. No. Those last two, I don't recall presenting those.

Q. Right. I mean if I understand, I know we talked about this in different contexts but if I understand Exhibit 10, this was -- these were your handwritten notes that you took into the meeting as part of your presentation, is that right?

A. Yes.

Q. Okay. As part of the reserve process were you -- did you gather documents and information for that as well?

A. Yes.

Q. That process, if I recall correctly, was undertaken in the first quarter of 2009, is that right?

A. Yes. Well, into May 2009. I guess the second quarter.

Q. Fair enough.

Let's say through May of 2009 because in fact the board meeting was on May 4, 2009, right?

A. Yes.

Q. Okay. And my sense is you were collecting documents pretty much until you made the presentation, correct?

A. I don't recall when that -- when the last document came that I relied on for that presentation.

Q. All right.

And did you -- how did you collect those documents?

A. I believe some were provided as hard copy and I don't recall if I had access to Share Point and the extranet sites or not. I don't recall.

Q. Now, once the -- this agreement was signed in February of 2009 I take it from what you earlier you testified that the majority of your time was spent doing this reserve review analysis, correct?

MR. ZEIGER: Object to the form.

Go ahead.

BY MR. LOTTERMAN:

Q. Just roughly.

A. I don't recall.

Q. So at the same time you were also doing work on the cost estimate, correct?

MR. ZEIGER: Object. What time frame are you --

BY MR. LOTTERMAN:

Q. I am talking about the February to May 2009 time period.

My understanding from your earlier answers is that you spent the majority of your time, I suspect given the time sensitive nature of the project, on the reserve review but you also were doing work on what I call the cost estimate project which is the subject of today's deposition.

A. What I remember and I don't have 100 percent recollection is most of it was focusing on the 2008 --

Q. Reserves?

A. -- time frame, yes.

Q. You were doing some work in preparation for this litigation and the opinions you have, in fact, rendered in this case, correct?

A. Yes. But I -- the bulk of that

work, just putting aside the amount of time, was really conducted separate from that after the board presentation.

Q. But some of it was done the same time, correct?

A. I believe so, yes.

Q. We don't need to go through this but I have your bills and it shows EDR is pulled for sites that aren't on your presentation. Is that -- does that refresh your recollection?

A. A bit.

Q. Okay. All right.

And there certainly was no sort of rule at the time that people couldn't work on the cost estimate while you and others may have been focusing the majority of your time on the reserve work, true?

A. Can I just back up? I am not aware of EDRs that wouldn't have been associated with service stations. So I am not sure if that is a good example, I would have to see what you are looking at there to answer that better.

Q. Well, El Dorado, Arkansas; Edwardsvillle, Illinois; Marion, Illinois; Bloomington, Indiana; Bogalusa, Louisiana?

A. Okay.

Q. I don't want to slow this down.

A. Well, I just want to make sure I answer correctly. And I appreciate when you said that, I wasn't -- thank you for refreshing my memory.

Q. Let me show you -- I want to clear up the service station issue very quickly.

I am going to show you two documents I hoped I wouldn't have to but I think to be clear we should.

MR. LOTTERMAN: Let's mark these as Exhibits 11 and 12 and I don't care which order you do them in.

(Document Bates stamped Roux 5858 to 5869 was marked Roux Exhibit 11 for identification)

(Document Bates stamped Roux 5867 through Roux 5873 was marked Roux Exhibit 12 for identification)

MR. LOTTERMAN: While Dr. Ram

Q. Roughly ten?

A. Ten.

Q. Okay. All right.

As part of that reserve review process did you have particular personnel work on particular categories or sites?

A. Brigid Milone was working on this at the time. Brigid Milone.

Q. On the service stations?

A. Yes.

Q. Okay. Who worked on the -- wood treating sites for the reserve review? That would be Mr. Scott?

A. I don't recall. It may not have been. I just don't recall at that point in time.

Q. How about the ag-chem sites?

A. I don't recall.

Q. Okay. If your invoices indicate that Mr. Scott was looking at Rome and Beaumont would those be wood treaters?

A. Yes.

Q. And if your invoices indicate that Mr. McTiernan was looking at Savannah, Rome,

Beaumont and Jacksonville, where would those fall in your category?

A. Savannah is ag-chem, ag-chem facility.

Rome is a wood treater.

What was the third?

Q. Beaumont?

A. Wood treating site.

Q. Jacksonville?

A. I am sorry. Did I say Savannah was ag-chem a moment ago?

Q. You did.

A. Let me correct that. That is a chemical plant.

Q. Okay. So Savannah is chemical, Rome is wood treating. Beaumont is wood treating.

What about Jacksonville?

A. Jacksonville would be ag-chem if it is the Jacksonville ag-chem site. There is two Jack -- there is also I believe Jacksonville Terminal.

Q. And who reviewed the Henderson reserves in that 2009 time frame?

A. That would be Nancy Nevins to the best I can recall.

Q. And again we established earlier if I recall that Henderson would be sort of one of the chemical sites?

A. Yes. It is a perchlorate site.

Q. Right.

And as part of that reserve review is it fair to say that the folks who assisted you had to look at documents that did not exist as of preNovember 2005?

A. Well, they did because again I wanted to have a general understanding of the entire site history for informational purposes and then focus whatever analysis was appropriate on those documents which were applicable to the analysis whether it is '05 or '08.

Q. As far as the reserve process goes they looked at documents before November 2005 and after November 2005, correct?

A. To the best I can recall, yes.

Q. In fact they had to do so as a

matter of necessity, correct?

A. Yes.

Q. Because you were looking at reserves set in 2008, true?

A. Yes.

Q. Okay. So is it fair to say that probably the more recent information was more relevant than say perhaps the 2003 information?

A. I don't know -- what do you mean by "more relevant"?

Q. To setting a reserve in 2008.

A. All the information could be relevant particularly if you are looking at trends. All of that information would be relevant.

Q. So I take it I don't need to spend more time hopefully establishing, for example, that for the purpose of the Jacksonville ag-chem site that the key documents that were identified as part of the reserve setting process included a 2006 draft feasibility study, 2008 final feasibility study, 2008 opposed fact sheet

and a 2008 environmental fact sheet, would that surprise you?

MR. ZEIGER: Object to the form.

THE WITNESS: You are looking at Roux -- Bates 177?

BY MR. LOTTERMAN:

Q. You know what. I will tell you what, I will need to put these in. I am sorry.

MR. ZEIGER: Why don't you mark them?

MR. LOTTERMAN: I will.

MR. ZEIGER: And asking him whether a document he hasn't seen says what it says.

MR. LOTTERMAN: I was trying to short circuit the process but that is not going to happen.

Let's mark this as Exhibit 13.

(Document entitled Reserve Balance was marked Roux Exhibit 13 for identification)

BY MR. LOTTERMAN:

Q. Do you recognize this document,

Dr. Ram?

A. Yes.

Q. Did it come out of your files?

A. Yes.

Q. Was it prepared by one of your staff?

A. Yes, under my direction.

Q. Understand.

And was it prepared as part of your, what we have been calling the Tronox reserve review?

A. It looks that way.

Q. Okay. And is Jacksonville an ag-chem site?

A. Yes.

Q. Okay. And does this document in fact list the four key documents that whoever prepared this document thought were important as part of that analysis?

A. Yes.

Q. And do three of those documents postdate November 2005?

A. Four of them do.

Q. Okay. At least three do.

Correct.

And then do you know who prepared this exhibit, 13?

A. This may have been Mr. McTiernan.

Q. Okay. And was Mr. McTiernan -- has he been involved with preparing the cost estimate for the Jacksonville ag-chem site in this proceeding?

A. Yes.

MR. LOTTERMAN: Let's mark this Exhibit 14.

(Notes taken by Nancy Nevins was marked Roux Exhibit 14 for identification)

BY MR. LOTTERMAN:

Q. Do you recognize this document, Dr. Ram?

A. Yes.

Q. And it indicates that these are notes taken by Nancy Nevins; is that correct?

A. They would be contemporaneous -- contemporaneous notes as Ms. Nevins reviewed project documents.

Q. And is the Henderson, Nevada site

as we discussed earlier a perchlorate site?

A. Yes.

Q. Okay. And did, in fact, Ms. Nevins handle this site as part of the 2009 reserve review?

A. Yes. Under my direction.

Q. And if you look at page 991 does she list some of the documents that she looked at as part of that review?

A. Well, all the pages list documents that she reviewed.

Q. Okay. Thank you.

And are many of those documents dated after November 2005?

A. Starting on page 6991, yes.

Q. Okay. And did Ms. Nevins -- has she had a role in preparing the 2005 cost estimate in this litigation?

A. Yes.

MR. LOTTERMAN: Let's mark this as Exhibit 15.

(E-mail from Mr. Scott to Mr. McTiernan was marked Roux Exhibit 15 for identification)

BY MR. LOTTERMAN:

Q. Do you recognize this document and the attachments?

A. Yes.

Q. And is this Mr. -- appears to be an e-mail from Mr. Scott, that is who we have been referring to earlier?

A. Yes.

Q. And then to Mr. McTiernan, is that right?

A. Yes.

Q. Okay. And this appears to address the Tronox reserve setting process as well, correct? Well, let's call it the Tronox reserve review process, correct?

A. Yes.

Q. And it appears to address Beaumont, Rome and Savannah, is that right?

A. Yes.

Q. If you look at, for example, pages 2619 there is a chart there involving the Beaumont site, correct?

A. Yes.

Q. And if you look on the very first

box under "comments" you will see a sighting of a July 2007 feasibility study, is that true?

A. Yes.

Q. Okay. And if you look at pages 2620 that appears to be a table prepared for the Rome site; is that right?

A. Yes.

Q. And that also indicates that the reviewer looked at Tronox's Rome projections for 2009, 2010 and beyond; is that right?

A. Yes.

Q. Next page that appears to be a table prepared for the Savannah site; is that right?

A. Yes.

Q. Okay. And that cites Tronox contractor estimates in 2008, if you look in the second far right column, second row.

Do you see that?

A. Yes.

Q. And those were all post November 2005, correct?

A. Correct.

Q. And did Mr. Scott -- so it appears that Mr. Scott was involved with the Tronox reserve review in 2009.

Has he also been involved with the -- your 2005 cost estimate project?

A. Only with respect to Beaumont and Rome.

MR. LOTTERMAN: Number 16.

(Listing of service station sites and information available, the date and author was marked Roux Exhibit 16 for identification)

BY MR. LOTTERMAN:

Q. This is the document I should have showed you earlier.

I have handed Dr. Ram Exhibit 16 and ask if he can identify it for me.

A. It is a listing of service station sites and information available, the date and author.

Q. Does it appear to be part of the Tronox reserve review that we talked about today?

A. Presumably.

Q. Can you tell who prepared this document?

A. It was likely prepared by Brigid Milone.

Q. And if you look at the names of the titles and the dates of the titles and the authors do a number of these appear to be citations of information that were available only after November of 2005?

A. Well, there are some that pre-date that as well.

Q. Yes. So you have some before and some after, correct?

A. Yes.

Q. Okay. And, I am sorry who did you say you think prepared this?

A. Brigid Milone.

Q. Okay. And did she also have a role in preparing the 2005 cost estimate for this litigation?

A. Initially but that role -- she left the company and that role was taken over by Mr. Swanson.

Q. And when did she leave?

A. Maybe a year-and-a-half to two years ago.

Q. Okay. Now, you also were very involved with the reserve setting process, correct?

A. Yes.

Q. And I take it at the end of the day you were the one that went to the Tronox board and made your presentation that is reflected in the exhibits we looked at earlier, true?

A. Yes.

Q. Okay. So as part of that process, if I understand correctly, did you meet with your staff to discuss the various information and sites that they were assigned to review?

A. Yes.

Q. And did you, in fact, review that information that they pulled yourself?

A. I would look at all of the primary documents that were used to derive a cost.

Q. Okay.

A. At a minimum.

Q. Okay. And if you look at Exhibit 10 you even looked at Tronox's actual expenditures through November of 2008 as part of that process, correct?

A. You are talking about the figures?

Q. I am talking about these terribly preproduced charts.

A. They look better in color.

Q. I am sure. I am sure it was a brilliant presentation.

But my point is this --

MR. ZEIGER: Stipulated.

BY MR. LOTTERMAN:

Q. My point is this, as part of this presentation to the board you not only looked at information from 2009 back but you also looked at --

A. 2008 back? Oh, 2009.

Q. 2009 back.

A. Okay.

Q. You also looked at Tronox's overall reserves and expenditures through November 2008, correct?

A. Yes.

Q. Not only for the specific 11 sites, which I believe is what the graph on 185 depicts, but also total expenditures and cumulative expenditures as of document 186, correct?

A. I believe the first graph is just a subset of the 11 sites and the second one is -- yes, I see the 91 million so that was probably the -- I believe that was for the entire 71 site portfolio.

Q. Right. And again, I realize this is a while ago. But let's make sure we are clear.

So document 185 and I know I have one minute, document 185 depicts the expenditures for the 11 sites through November of 2008, is that right?

A. And associated reserves and change in reserves.

Q. Exactly.

A. Yes.

Q. And then exhibit -- or document page 186 shows the monthly and cumulative for the total portfolio, shall we say, of

reserve sites of Kerr-McGee at the time -- or Tronox at the time, I am sorry?

A. Listed in schedule 2.5A, yes.

Q. Exactly. Right.

MR. LOTTERMAN: Let's take a break.

THE VIDEOGRAPHER: The time now is 11:59 a.m.

This is the end of Tape number 2 and we are off the record.

(Luncheon recess: 11:59 a.m.)

another way?

BY MR. LOTTERMAN:

Q. I am going to leave that one alone.

Let's look at the second clause you said, among other things, and the second clause says, the necessary and appropriate future -- environmental costs -- I am sorry. Let me read it over.

"The necessary and appropriate future environmental costs at 28 sites including the Libby, Montana Superfund site."

Do you see that?

A. Yes.

Q. Okay. What was -- what did that involve?

A. It was, to the best I recall it was essentially similar to what I am doing here, providing future costs at 28 sites including Libby that were knowable and necessary and appropriate.

Q. So that was my question were you applying the known and knowable standard in

this context as well?

A. The text I do recall because I looked for that specifically. It just says "known." It doesn't use the phrase "knowable" but I believe I -- as best I recall I applied a knowable concept as well there.

Q. And in your earlier testimony you said it involved 32 properties?

A. Yes, it looks like I state 28 here.

Q. Okay. So that is a clarification?

A. Yes.

Q. Okay. And then the third clause says, "The adequacy of W.R. Grace's estimated future environmental costs for the sites at issue."

What did that entail?

A. W.R. Grace had a number for their portfolio and I evaluated that number relative to the cost estimate that I derived.

Q. What was the issue in the litigation?

2009 as of 2008; is that right?

A. Yes.

Q. And as part of that process you gathered information through May of 2009, true?

A. Yes.

Q. In fact you reviewed that information, right?

A. Probably April of 2009.

Q. Let's go with April. And in fact you reviewed that information, correct?

A. Yes.

Q. In fact you relied on that information in preparing the numbers that you gave to Tronox' board on May 4, 2009, true?

A. Yes.

Q. Around the same time you began estimating Tronox's future costs for sites as of November 28, 2005, correct?

A. Yes. And my instructions to my team was, you are now in a time machine and you are going back to November 30 of 2005 and you should only use documents that are

available once you arrive at that date in your time machine.

Q. But they had already looked at documents past 2005, correct?

A. That was the mindset that I demanded of my team and of myself, that even though we had reviewed documents later we were now going back in time and those documents no longer exist and we are only looking at documents as of the IPO or that was knowable as of the IPO.

Q. Did you wall off their access to those documents?

A. Did I what?

Q. Did you wall off their access to those documents?

A. No.

Q. Okay. Did you prohibit them from gathering post-IPO documents as part of the project?

A. Well, in fact, as you know my chronology goes beyond the IPO so that it tells the whole story so they obviously weren't walled off because they had -- I did

want the introduction to each chapter to tell the whole story and then to get in our time machine and go back to November 30, 2005.

Q. Did you prohibit them from gathering documents post-IPO as part of the project, specifically prohibit them?

A. There were no specific prohibitions.

Q. Did you specifically prohibit them from reviewing --

A. But again their instructions were not to rely on those documents when they developed -- when the cost development -- the costs were developed for the IPO date.

Q. They could look at them, correct?

A. They could look at them in the context of telling the story but the instructions were they don't exist. I used those words. Those documents -- when you go -- when the time to do the costing they don't exist.

Q. So no prohibition against them gathering them, no prohibition against them

reviewing them, no prohibition against them considering them, correct?

MR. ZEIGER: Object to form.

THE WITNESS: I will just repeat it. Not only --

BY MR. LOTTERMAN:

Q. That is a yes or no.

A. It is not a yes or no because as I said each chapter tells the whole story. So they were not prohibited. In fact, they were instructed to look at them in order to tell the whole story in terms of considering them, they were instructed to consider them in terms of telling the life cycle story of what happened at each individual site.

In terms of the costing as of the IPO they were instructed that those documents don't exist.

Q. Do you think that is possible?

A. Yes, I do. And I -- in the process when, you know I repeated, where is this document, where is it from, and yeah, one or two did slip through and I think a total of two slipped through. But yes.

Ram

More importantly, if you look at the basis for costs for each of them they are known or knowable documents or information.

Q. Why didn't you -- the other question I had is, why did you assign the same people who did the post-IPO review to the preIPO review? Why didn't you have Mr. McTiernan who handled the wood treaters do Henderson and Ms. Nevins do the wood treaters?

A. Then I would have two people looking at the -- well, at identical documents and the costs would be higher. It is not efficient to do it that way.

Q. But the alternative is you have Mr. McTiernan who looked at documents through April -- let me finish the question.

A. Well, I was trying to finish my answer but that is okay.

Q. You have Mr. McTiernan looking at documents through April of 2009, you then -- do you believe he can really go back and turn back the clock and put the genie back

in the bottle and say, okay, what was known or knowable as of November 2005, do you think that is truly possible?

A. Well, I think what you are missing is that if I pick a cost basis, yes, in the back of their minds maybe they know there is a future cost basis but the number they have to actually put in the cost estimates and cite has to be a known or knowable document as of '05 so, you know they may know, for instance, at Hanover that there has been a Phase III but when we wrote the cost estimate for Phase III you may have noticed that I used props because the Phase III didn't exist.

So Nancy who worked on that knew of that document, in fact described it but when we went to cost it she and I went into our time machine and that Phase III didn't exist. And we used -- we costed it based on only information that was known or knowable.

And if you look chapter by chapter, I am talking in general terms, you will see that these documents that are

example because, you know, there was a detailed report on the remedy selection that was actually selected for implementation and yet it wasn't used even though we knew what the cleanup remedy was going to be based on that. It doesn't exist. Sorry. I mean it is just part of the story but now that you do your costs you can't use it. That document doesn't exist.

Q. In some instances in addition to those that slipped through the cracks, you actually went back after you received the Gnarus report and tried to locate additional documents not cited in your first report, correct?

A. You are talking about after the Gnarus rebuttal report was issued?

Q. Yes.

A. Yes, that is pretty clear. There were a couple of -- beyond those two, there -- I think there were two or three others again out of the 372 sites where it slipped through the cracks, yes, but it turns out that there was -- there was preIPO

documents with the same information in it.

Q. How do you avoid bias in that case? In other words, you have established, that -- and I will stop mentioning Mr. McTiernan. I will talk about Ms. Nevins -- you have established that one of your staffers has used a post-IPO document and then you go back and ask them to search the record to find a preIPO document instead. Why is not that result, that cost, biased?

A. Well, if the document says the same thing there is no bias. It is just the fact that was a post-IPO document is also presented in a preIPO document. It is just a fact.

And, no, there can't be a fact -- a fact and it is 300 tons in 2006 and there is 300 tons in 2005. There is no interpretation. You are just using that number out of a pre -- out of a preIPO document.

Q. And the fact that he only had the 2009 document in his hand and not the 2005 that doesn't trouble you?

would not.

The reason I picked 50 percent is I had no basis to assume that more would be contaminated nor did I have any basis to assume that less than 50 percent would be contaminated so the only number I could pick defensibly based on -- that has a true actual basis of picking a number is 50/50.

It couldn't be zero based on operations. I knew that some of them would be contaminated nor did I have enough information about site operations at the blenders to assume that 100 percent of them would be contaminated so I picked 50/50.

Q. You applied your professional judgment, right?

A. More than that. I applied my professional judgment plus the -- coupled with the fact that I had no technical documents to pick -- to form a basis to pick anything other than 50/50.

If I picked 90/10 or 70/30 I would -- that would be purely subjective and I didn't believe that using a subjective

number in assigning a probability with such huge implications in the cost outcome was appropriate.

Q. 50/50 is a coin toss, isn't it?

A. No. 50/50 and I just explained. I will go through it again.

I had no reason to believe that -- I had no data to tell -- to verify that more than 50 percent would be contaminated nor did I have any project documentation to indicate that less than 50 percent would be contaminated so because of that any ratio other than 50/50 I would have no basis for.

50/50 was the only combination that had some technical basis. No other combination of probabilities, it would be worse than a coin toss. It would be pure guesswork.

Q. It is my understanding that you applied the -- one of the methodologies you applied in cost estimating in this case was the most likely value; is that right?

A. Yes.

Q. And if I understand that approach

correctly it captures the cost of the scenario believed to be most likely to occur, is that right?

A. Yes.

Q. Is there a percentage you could put on that likelihood?

A. I don't believe ASTM defines a percentage.

Q. Do you apply one in your head?

A. It is pretty -- I don't have a specific percentage. It is really again the project documents as I read them clearly indicate that this is the path of the most likely outcome, most likely scenario based on the project documents.

Q. Is there a certain threshold you need to reach like 50, 60, 70 percent to reach that conclusion?

MR. ZEIGER: Object to the form.

THE WITNESS: I don't think -- I can't put a percentage because if I put a percentage on, let's say I say 70 percent then I have to acknowledge that there is a 30 percent likelihood

that is not going to occur and then I would have to essentially go through the probablistic approach.

And again I have -- there is no basis of assigning a 70, a 30, a 40, a 10, whatever, so in cases where I didn't have -- I didn't have confidence of the outcome that was most likely to occur and ASTM itself does not -- if ASTM thought there should be a threshold for MLV, I am sure they would -- I expect they would have put it in there but they don't, it is professional judgment.

But what they say, if you don't -- if you are -- if you don't have enough information to select that is most likely to occur, you can do a range and when I wasn't confident enough of the most likely value I did use a range.

BY MR. LOTTERMAN:

Q. In your view is "most likely" more than 51 percent?

MR. ZEIGER: Object to form.

THE WITNESS: I am sorry. I can't

putting a contingency on is just not something done in standard engineering practice.

Q. But your report on Crest Creek, Section 4.1.1 indicates that your use -- your judgment to use a 25 percent contingency is "supported by costs that were incurred after November 2005" and then you cite one, two, three, four documents that didn't even exist as of the IPO; is that right?

A. That is what the document says but again it was -- I am in my time machine. I do my cost estimate. Nothing exists in the year subsequent to the IPO.

I put my estimate and in standard engineering practice in accordance with 1997 guidance and, quite frankly, many other guidance documents, I put a 25 percent contingency on a project of this magnitude. There is my cost estimate.

I now get into my time machine. I fast forward and I look at what actually was done and I said, you know, I guess that 1997

guidance putting 25 percent that is probably why they wrote that 1997 guidance because Murphy's law happens on cost estimates. Things go wrong. Rain events happen. It takes longer. There are field logistical things. I have been out in the filed. I always add a contingency on -- because the worst thing I want to tell a client is it going to cost X and it comes in coming 1.25X. I would far rather tell them it is going to cost 1.25X and come in at X if I can -- if Murphy's law doesn't happen which it generally does unfortunately.

Q. 4.2.6, Streetersville?

A. Okay.

Q. What type of site is Streetersville?

A. This is downtown Chicago thorium from fill associated with Lindsay Light.

Q. And the contaminants of concern there?

A. Thorium radiation.

Q. And if I understand this portion of your report you used 2010 information

whatever is knowable as of November 2005?

A. Specifically for Lukachuka Mountains, yes.

You know, I would have to -- if you are talking about some $100,000 piece of equipment, I am not sure, you know, clearly, this was something that was readily knowable with a fairly inexpensive piece of equipment that was available and could have been determined at that time.

Q. Let's turn to page 109 of this report.

What data do you use to derive the unit costs for the waste loading and transportation, the radioactive waste tipping fees and the state tipping fees?

A. I believe this was another example in the table of post-IPO that I asked my team to see if this information could be determined with preIPO information.

Q. So when your report came out initially you relied on information as of 2009, correct?

A. Post-IPO. I would have to look up

the exact dates.

Q. And no argument here about known or knowable, right?

A. Correct.

Q. Okay. So what you did is you directed your staff to go back after you got Gnarus' report and try to find preIPO information, didn't you?

A. Again, I wouldn't characterize it that way.

I would say I tasked them to see could this -- was this information knowable based on post -- preIPO information.

Q. And were they able to find preIPO information?

A. We, in some cases, yes, in another case we ran -- actually ran RACER based on 2005 cost data.

Q. So in at least one case you were unable to find preIPO information so you developed your own RACER model to address it, correct?

A. Another way I would say it is, in my time machine having seen there was no

preIPO information, RACER would have been the next best way of getting that information by actually calculating it in that manner which is what I did in my rebuttal report.

Q. How expensive -- your earlier answer, how expensive does a piece of equipment have to be to factor into your knowable valuation?

A. I guess I would just say if it is something that is readily available rather than putting a price tag on it.

Q. "Readily available." Do you mean in the marketplace?

A. No. Someone like a Kerr-McGee Tronox manager at the time of 2005 could say, you know, I really am interested in knowing if there is X at this site. What piece -- is there a piece of equipment I can bring with me on a site inspection to determine if it is there or not.

MR. LOTTERMAN: Good time to break.

THE VIDEOGRAPHER: The time is

Ram

Had I included that which was preIPO on a perchlorate site with 51 that total would have been closer to 150 or between 70 and 75 million so even taking the NASA JPL site, even taking -- considering the fact that I didn't include Henderson the 58 million is still conservative based on preIPO information.

Q. I guess my question is a little bit different.

What I am wondering is how did this post-IPO data get into your time machine?

A. There was probably a little bit it of a disconnect because it was not a Tronox portfolio and it was a metric and in developing the metric maybe the filter of whether that was appropriate or was not appropriate was a little muddier to rely on a post-IPO document for developing a metric and then apply it to $2,005 at a Tronox portfolio site.

Q. Did one of your staffers at least prepare the initial cost estimate for this

site?

A. For, for undisclosed perchlorates?

Q. For the Wecco site, correct.

A. Yes.

Q. Who was that?

A. That was Tom, Tom Buggey.

Q. Did you go back and ask him why he even considered yet alone relied upon a post-IPO document in developing this process?

A. Tom doesn't operate in a vacuum. I mean I am intimately involved in everything that is coming out and as I said I wasn't -- it wasn't clear to me, I mean ideally, yes, if I -- there weren't a lot of perchlorate sites that I could get information to develop a metric.

A static of one site if I based it on one I would be sitting here defending how I can develop a metric from one so we found a second site. It was post-IPO to develop a metric based on conditions at the Tronox legacy sites, the perchlorate sites as of 2005. So it is a slightly different case

because it is not -- it is a metric that is being applied.

It is not a post-IPO Tronox document probably is the best way of saying it.

Q. When you worked with your staffer in developing this cost estimate why didn't you catch this?

A. It is not a matter of catching it. I mean I read it. I helped write it. I actually -- I did -- I was the primary author ultimately on all these sections.

And it wasn't a matter of catching. It was a matter of as I just explained and just to make it crisper in the rebuttal I said, oh, let's just take this off the table and reevaluate that metric but if we take that one out I can't have a universe of one so I have to at least suggest putting Henderson in as a second site to base a metric on.

Q. But again, you decided to do that after Gnarus pointed it out to you, correct?

A. I think you are missing my point.

Ram

I don't think this was -- this wasn't, at least to the best of my recollection this was not a case of putting this in as a mistake. As an oops factor.

To the best I can remember and it was, you know, a very intense six weeks writing this and pulling everything together is that there was a limited number of sites, I was not -- I didn't think a metric of one was very good or it is okay if that is all you have but I basically was able to double the fact that I had a second site in the -- in that cost range, it was a post-IPO, it wasn't a post Kerr-McGee IPO but it was a basis of providing a metric.

When Gnarus' report came in and said, I am relying on IPO, post-IPO, well, it is not a post-IPO Kerr-McGee document and so I responded, okay, so if I take that out, I still want a second site to kind of calibrate my metric and that is how I responded in my rebuttal.

Q. So when you prepared your reports did you draw distinction between post-IPO

Ram

Kerr-McGee information and post-IPO anyone else?

A. In the case of Wecco, if I had a universe to create a metric based on preIPO documents I had no need to even consider post-IPO documents.

In the case of Wecco this is the one situation where I couldn't do a site specific cost. There wasn't enough information.

So how could I come up with a defensible approach to cost these out, perchlorate sites, highly toxic, the releases occurred, they are mobile, they are not going to go away so I know there is a problem at these sites. All right, so what is it going to cost?

So I have the Whitaker bromite. I know that is a preIPO basis but that is only one document. I really didn't want to rely one document.

So, yes, there was a second site. It was relying on post-IPO but it did -- it calibrated the one site so I felt it was

appropriate to put that in. So the case, this one is a little different in that the number of documents I could find to develop a metric in the case when I wrote this report did require a post non-Kerr-McGee IPO document.

Then to be conservative when I saw the Gnarus report I said okay, if that is going to jeopardize the credibility of my number then let me calibrate that number with Henderson.

Q. Okay. So if I understand you correctly what you are saying is that this case was not an oops, something got through the firewall into the time machine, correct?

A. As I recall. To the best of my recollection I remember discussing it and just not feeling comfortable with relying on a metric with one site.

Q. And so you made an affirmative decision given the lack of information to develop a metric to rely upon post-IPO data albeit not from Kerr-McGee, correct?

A. To calibrate the Whitaker bromite

particular row you can see the cost estimate for that site.

Q. Then you calculated the cash flow on using $2,005; is that right?

A. No. It is the reverse.

Q. Okay.

A. I populated the cost elements into the years in which they could reasonably be anticipated to occur based upon the cost elements and then those were discounted back to 2005 as net present value.

Q. And you populated the cost elements based on your deterministic approach, is that right?

A. I wouldn't characterize it that way. Even if you used a probablistic approach, the table I used would be amenable to deterministic or probablistic. The outcome of my cost estimating said you are going to spend XYZ on cost elements ABC.

Now I need to put it into the -- whether that was determined probablistic or deterministic you get a number and now you have to figure out when that number is going

understand the foundation of this thing.

A. Okay.

Q. If I understand correctly Section 3 identified the methods that you used to determine the present value of the site portfolio, correct?

A. Yes.

Q. And --

A. Or coupled with section 2.

Q. Fair enough.

And in my layman's terms you took undiscounted numbers and you discounted them using a rate supplied by someone else in this case, correct?

A. Yes.

Q. And that rate was 2.5 percent, is that right?

A. Yes.

Q. Okay. Now was that a real or nominal discount rate?

A. It was the number I was instructed to use in the table.

Q. Okay. And do you know the difference between a real and nominal?

A. I don't know the definition of that explicitly, no.

Q. Okay. Again, are you familiar with the term "net present value"?

A. I don't -- If there is a distinction between present value and net present value I don't know the subtleties.

Q. Okay. Is there a distinction between net present value and a discounted rate?

A. I am not familiar with the subtle differences between those two terms either.

Q. Let's turn to page 3 of this Section 3.

Now, if you look down into the second category it is called "Calculate present value for each cost estimate."

Do you see that?

A. Yes.

Q. And it cites a formula, is that right?

A. Yes.

Q. And I believe you used that formula to estimate the discounted or --

Ram

DEPOSITION ERRATA SHEET

Assignment No. 308787

Case Caption: In Re: Tronox,

Incorporated

DECLARATION UNDER PENALTY OF PERJURY

I declare under PENALTY OF PERJURY that I have read the entire transcript of my Deposition taken in the captioned matter or the same has been read to me, and the same is true and accurate, save and except for changes and/or corrections, if any, as indicated by me on the DEPOSITION ERRATA SHEET hereof, with the understanding that I offer these changes as if still under oath.

_____

NEIL M. RAM

Subscribed and sworn to on the _____ day of _____, 2011 before me,

_____

Notary Public,

in and for the State of _____.

Ram

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NEIL M. RAM

EXHIBIT B

Designation: E 2137 – 01

Standard Guide for Estimating Monetary Costs and Liabilities for Environmental Matters[1]

This standard is issued under the fixed designation E 2137; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 *Purpose*—The purpose of this document is to provide a standard guide in the United States for estimating *costs and liabilities* for environmental matters.[2] Many possible uses for estimates of *costs and liabilities* for environmental matters exist, including but not limited to business decision making, communications and negotiations involving change of property ownership, regulatory requirements, third-party lawsuits, insurance premium calculation and claim settlement, change of property use, revitalization, compliance planning, construction, analysis of remedial alternatives, budgeting, strategic planning, financing, and investment analysis by shareholders. The use of estimated *costs and liabilities* developed in accordance with this standard may be subject to other standards applicable to the matter involved. For example, it is not intended to supersede accounting and actuarial standards including those by the Financial Accounting Standards Board and the U.S. Security and Exchange Commission. This standard does not address the establishment of reserves or disclosure requirements.

1.2 *Objectives*—The objective of this standard is to provide guidance on approaches for estimating *costs and liabilities* for environmental matters.

2. Referenced Documents [3]

2.1 *ASTM Standards:*

E 1527 Environmental Site Assessments: Phase I Environmental Site Assessment Process[4]

E 1739 Risk-Based Corrective Action Applied at Petroleum Release Sites[4]

PS 104-98 Provisional Guide for Risk-Based Corrective Action[5]

2.2 *Other Document:*

EPA OSWER Directive 9610.17 concerning use of risk-based decision making, 1995.[6]

3. Terminology

3.1 *Definitions:*

3.1.1 *allocation or allocated share*—the portion of cost or liability for which a party is responsible for payment or reimbursement.

3.1.2 *environmental compliance*—operations, permits, equipment, facilities, products, records, documentation, reports, training, procedures, inspections, certifications, monitoring, controls, or other conditions or activities that must conform to environmental statutes including, but not limited to, CAA, CWA, OPA, RCRA, CERCLA, TSCA, FIFRA, SDWA, and state and local laws.

3.1.3 *costs and liabilities*—economic expenses, accrued liabilities, and loss contingencies.

3.1.4 *estimator*—an individual or entity that prepares and analyzes *costs and liabilities*.

3.1.5 *event*—a condition or incident which occurred, or may occur, with respect to an environmental condition and/or *environmental compliance* issue, that affects or leads to potential *costs and liabilities*. Examples of events include: a new requirement for air emission controls (e.g., NO_x), a hazardous waste site that requires remediation, a claim for personal injury related to an alleged environmental incident, or the need to comply with NPDES standards as a result of a process change.

3.1.6 *liability*—an actual or potential obligation that may or may not be accrued.

3.1.7 *orphan share*—liability assigned to a PRP that cannot be located or that is insolvent, or the liability associated with pollutants which cannot be attributed to a PRP.

3.1.8 *potentially responsible party (PRP)*—any individual, legal entity, or government—including owners, operators, transporters, or generators—potentially responsible for, or contributing to, the environmental impacts at an event.

3.1.9 *studies*—investigations such as regulatory interpretations and applicability studies, compliance analysis, operating scenarios study, engineering design and analysis, cost estimation, process hazard analysis, modeling, communication plans,

[1] This guide is under the jurisdiction of ASTM Committee E50 on Environmental Assessment and is the direct responsibility of Subcommittee E50.05 on Wetland Ecosystems.

Current edition approved Mar. 10, 2001. Published May 2001.

[2] For the purposes of this standard, costs and values are defined as monetary estimates.

[3] Appendix X1 includes citations for additional relevant documents and requirements from other organizations including FASB, SEC, and AICPA.

[4] *Annual Book of Standards*, Vol 11.04.

[5] Discontinued—see 1999 *Annual Book of Standards*, Vol 11.04.

[6] Available from U.S. Environmental Protection Agency, 1200 Pennsylvania Avenue, NW Washington, DC 20460.

preliminary investigation, sampling and analysis, site assessment, site characterization, Phase I and II studies, remedial action plan, remedial investigation, contamination assessment report, feasibility study, risk assessment, treatability study, ecological impact assessment, environmental impact report, work plans, ASTM Risk-Based Corrective Action (RBCA) analysis, RCRA facility investigation, RCRA facility assessment, report of waste discharge, corrective measures study, corrective action report, health and safety plan, quality assurance plan, and other studies.

3.2 *Acronyms:*

3.2.1 *AICPA*—American Institute of Certified Public Accountants.

3.2.2 *CAA*—Clean Air Act.

3.2.3 *CERCLA*—Comprehensive Environmental Response, Compensation and Liability Act of 1980 (as amended, 42 USC Section 9601 et seq.).

3.2.4 *CWA*—Clean Water Act.

3.2.5 *EPA*—United States Environmental Protection Agency.

3.2.6 *EV*—expected value; an estimate of the weighted mean value of an unknown quantity that represents a probability-weighted average over the range of all possible values.

3.2.7 *FASB*—Financial Accounting Standards Board.

3.2.8 *FIFRA*—Federal Insecticide, Fungicide and Rodenticide Act.

3.2.9 *MLV*—most likely value.

3.2.10 *NPDES*—national pollutant discharge elimination system.

3.2.11 *OPA*—Oil Pollution Act.

3.2.12 *PRP*—potentially responsible party.

3.2.13 *RBCA*—Risk-based corrective action.

3.2.14 *RCRA*—Resource Conservation and Recovery Act (as amended 42 USC Section 6901 et seq.).

3.2.15 *SDWA*—Safe Drinking Water Act.

3.2.16 *SEC*—Securities and Exchange Commission.

3.2.17 *TSCA*—Toxic Substances Control Act.

4. Significance and Use

4.1 *Use*—The standard is intended for use on a voluntary basis by an estimator of *costs and liabilities* for environmental matters. The user may elect to apply this standard for any or all uses outlined in the Purpose. Application of this standard for one use does not compel application of the standard for all or any other use.

4.2 *Principles*—The following principles are an integral part of this standard and should be used to resolve ambiguity or dispute regarding the interpretation of estimated *costs and liabilities* for environmental matters.

4.2.1 *Uncertainty Not Eliminated*—Even though an estimate of *costs and liabilities* for environmental matters is prepared in accordance with this standard, uncertainty remains with regard to, among other things, the resolution of contractual, technological, regulatory, legislative, and judicial issues, which could affect the *costs and liabilities*.

4.2.2 *Periodic Review of Assumptions and Estimates*—Assumptions underlying these estimates should be reviewed periodically for the purpose of incorporating additional information that may become available. For example, changes in regulatory requirements, technology, property use, inflation, or other issues may affect the basis for the estimates, therefore necessitating revisions.

4.2.3 *Comparison with Subsequent Estimates*—Subsequent estimates based on additional information should not be construed as indicating the prior estimates of *costs and liabilities* for environmental matters were unreasonable at the time they were made. Estimates should be evaluated on the reasonableness of analyses and judgments made at the time and under the circumstances in which they were made. Subsequent improvements in estimates should be made as more information becomes available, but these improved estimates should not be considered valid standards on which to measure the reasonableness of a prior estimate based on hindsight, new information, use of developing analytical techniques, or other factors. However, information on trends in estimates over time may be of value to a user of financial statements or other users of the cost and liability estimates.

4.2.4 *Not Exhaustive*—Estimation of *costs and liabilities* for environmental matters does not necessarily require an exhaustive evaluation of all possible outcomes. A point exists at which the cost of obtaining information or the time required to gather it outweighs improvement in the quality of the estimate.

4.2.5 *Assessment of Risk*—The actual or potential risk to human health and the environment should be considered in assessing environmental matters. The degree of risk should be a factor in developing the cost and liability estimates associated with those matters.

4.2.6 *Estimator Selection*—An appropriate estimator or group of estimators will consist of those individuals or groups who possess sufficient knowledge, training, and experience to develop appropriate estimates for the *costs and liabilities* being estimated. It is the responsibility of the entity sponsoring the cost and liability estimates to select an estimator with the appropriate level of knowledge, training, and experience for the parts of the estimation effort for which that estimator is responsible.

5. Procedures for Estimating *Costs and Liabilities* for Environmental Matters

5.1 *Determination of Relevant Information and Types of Costs and Liabilities*:

5.1.1 There are many types of *costs and liabilities* for environmental matters, including, but not limited to:

5.1.1.1 Studies,

5.1.1.2 Response action,

5.1.1.3 *Environmental compliance*,

5.1.1.4 Defense and legal fees,

5.1.1.5 Fines and penalties,

5.1.1.6 Reimbursement of agency oversight, or

5.1.1.7 Damages arising from resource damages, ecological damages, property damage, business interruption, bodily injury, or tort claims such as nuisance and negligence claims.

5.1.2 After identifying the conditions giving rise to potential *costs and liabilities* for environmental matters, existing relevant information should be considered to estimate *costs and liabilities* identified in 5.1.1, including, but not limited to:

5.1.2.1 Event type (for example, new EPA air emission control requirements, leaking landfill, site PRP notice, compliance audit findings),

5.1.2.2 Number and location of affected operations/facilities,

5.1.2.3 Use of surrounding property,

5.1.2.4 Past, current, and potential future site uses,

5.1.2.5 Studies,

5.1.2.6 Environmental risks posed by the event,[7]

5.1.2.7 Bodily injury or other claims related to the event,

5.1.2.8 Relevant state or other regulatory requirements and alternatives,

5.1.2.9 State or federal agency involvement,

5.1.2.10 Public involvement,

5.1.2.11 Planned or completed remedial activities,

5.1.2.12 Decision documents (for example, Records of Decision),

5.1.2.13 Litigation activities related to the event (for example, claims, suits, actions, demands, requests for payment, notices),

5.1.2.14 Resources, tasks, and deadlines,

5.1.2.15 Available technologies and designs,

5.1.2.16 Type and extent of contamination,

5.1.2.17 Number of operable units (CERCLA) or solid waste management units (RCRA),

5.1.2.18 Involvement of various parties at the event, and

5.1.2.19 Information on prior experience with similar events.

5.1.3 The organization and application of the foregoing information may be further subject to corporate, accounting, or regulatory policy decisions. The user will need to determine what these policy decisions are, and assess their effect on the cost estimate. Examples of such policy decisions include, but are not limited to:

5.1.3.1 Measuring and recording of contingent liabilities,

5.1.3.2 Technical policy decisions or interpretations to be made by regulatory agencies,

5.1.3.3 Acceptable levels of risk (for example, business risk, human health risk, ecological risk),

5.1.3.4 The degree to which societal or external costs and benefits are considered,

5.1.3.5 Whether or not life cycle costs are considered,

5.1.3.6 The degree to which sustainability/sustainable development are considered,

5.1.3.7 Local environmental management system criteria, including trade-off of emissions across environmental media, alternative methods and permitting options, auditability, and performance oriented metrics.

5.1.3.8 Level of organizational involvement and scrutiny,

5.1.3.9 The degree of communication and involvement with the public.

5.1.4 In the absence or insufficiency of such information, an assessment should be made of the applicable regulatory and industry standard requirements, and a determination made as to whether based on these requirements, significant *costs and liabilities* for environmental matters may be incurred that would indicate the need for further data creation and analysis in the future.

5.2 *Selection of Estimation Approaches*—A decision framework for estimating *costs and liabilities* for environmental matters is required. For purposes of naming various estimating methods, the following terminology is used:

Expected Value (EV)
Most Likely Value (MLV)
Range of Values
Known Minimum Value

5.2.1 The decision to use one or more of these four estimating methods or another method for a particular purpose is not arbitrary. The informational value of the estimate supplied by any one method is not equivalent to the others. When the uncertainties are great (for example, when an event is first identified) it may not be possible to make a reasonable cost estimate.

5.2.2 The robustness and comprehensiveness of an estimate and the quantification of uncertainty about the estimate, given adequate information, generally decreases moving from top to bottom of this list of methods. (See Fig. 1.) Depending on availability of information and circumstances, the level of effort required to prepare estimates at the top of the list is typically greater than the bottom of the list. However, given the principles cited in Section 4, it is not necessarily true that the "best" estimate for a given set of circumstances will always be the expected value.

5.2.3 The estimator should take into account the number of events and quality of the information available or obtainable

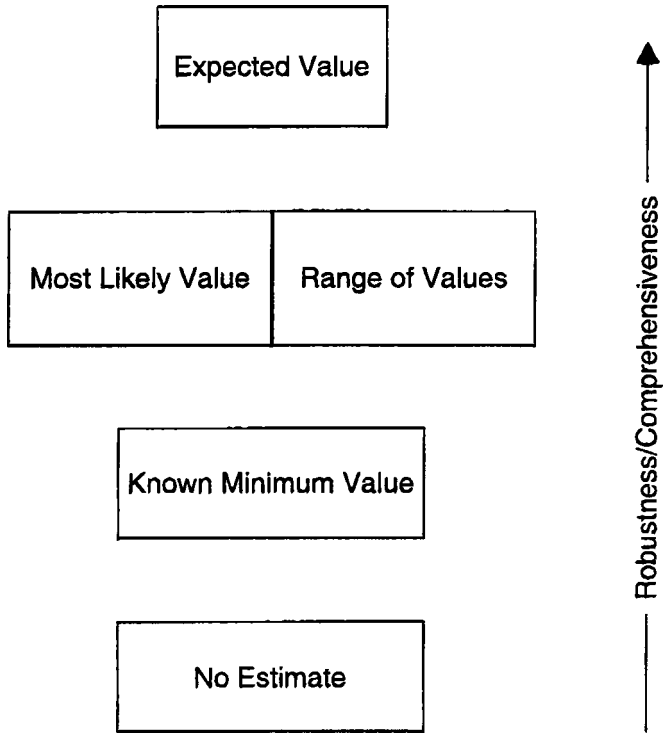

FIG. 1 Hierarchy of Approaches for Estimating *Costs and Liabilities* for Environmental Matters

[7] See Guide E 1739; PS104-98; EPA Risk Characterization Program; The Presidential/Congressional Commission on Risk Assessment and Risk Management; and EPA OSWER Directive 961.17 concerning use of risk-based decision making, 1995.

when selecting the cost and liability estimation approach to be used.

5.3 *Sources of Uncertainty in Estimation*:

5.3.1 For environmental issues, multiple outcomes often exist for a given issue as it develops toward resolution. Regulatory actions, event characterization information, remedial action effectiveness, legal matters, insurance aspects, and the like, are variables that are often not predictable with certainty. These uncertainties indicate multiple possible outcomes, each having its own probability of occurrence. Each outcome, if it occurs, has its own estimated value based upon its component outcomes.

5.3.2 The accuracy of an estimate, or sum of estimates (for application to multiple independent events), is ultimately measured by comparison of the predicted cost or liability to the actual outcome. There are at least two dimensions to accuracy in this context: the probabilities that certain outcomes will occur, and the component cost estimates for each of the outcomes.

5.3.3 To predict the value of each outcome, cost estimates are prepared that can range from very imprecise to rough approximations to engineering estimates of increasing degrees of detail. It may be possible to prepare a very accurate engineering estimate for a technical solution to a compliance or remediation requirement, but unless that specific technical solution is actually used in resolution of the event, the value of the precision may not be realized. Hence, the estimate's accuracy is affected by both the accuracy of the probabilities (that a particular technical solution will be applied) and the costs associated with each potential outcome.

5.4 *Detailed Description of Approaches for Estimation*

5.4.1 *Expected Value*:

5.4.1.1 There are several approaches to calculating an expected value, which is an estimate of the mean value of an unknown quantity that represents a probability-weighted average over the range of all possible values. One method, the decision tree approach, derives an expected value and distribution of potential values through the following steps: (*1*) identify the key issues contributing to the magnitude and timing of event costs, (*2*) develop a decision tree or simulation model of potential event outcomes (including possible allocation scenarios), (*3*) estimate the cost for each potential outcome, (*4*) determine the likelihood of each outcome, and (*5*) calculate the distribution of potential costs and the expected value, which is the probability-weighted cost calculated from items (*2*) through (*4*) above.[8] The information developed from the distribution may be very useful in conveying information about uncertainty, as described below in 5.8.

5.4.1.2 The estimator should be careful to include realistic outcomes with statistically significant probabilities to avoid shifting the expected value through the addition of extreme outcomes with insignificant probabilities of occurrence. Statistical significance will vary depending on the quality of data, the magnitudes of the outcomes, and the presence of outliers.

5.4.1.3 Outcome probabilities should be based, to the extent practicable, on statistical data drawn from comparable events. Where there are a large number of events, statistical approaches to estimating the expected value may be particularly appropriate. It is important to realize statistical approaches can be predictive of aggregate *costs and liabilities*, even if expected values for individual events are at variance from the actual results.

5.4.1.4 Another method for calculating an expected value is an actuarial approach, where historical data are available to estimate the expected value for similar events. Care should be taken when using historical data for estimating costs to assure that the data are applicable to the *event(s)* in question. Care should also be taken when using historical data due to the effects of changes such as technology enhancements, modified laws and/or regulatory policy, the changing application of presumptive remedies, and the application of risk-based corrective action approaches that could significantly alter current and future costs. Considerations should also be given to the potential loss of relevant information through application of statistical means or averages which may not convey information concerning uncertainty.

5.4.1.5 These approaches can be used in combination as appropriate. Other approaches to estimating an expected value may include simulation modeling and Monte Carlo analysis, for example, to estimate cost distributions.

5.4.2 *Most Likely Value (MLV)*—When an expected value approach is not practical or appropriate, a most likely value could be developed using engineering estimates. This MLV captures the cost of the scenario believed to be most likely to occur (for example, a stated preferred remedy). Typically, the estimator exercises a priori judgements (based on experience) about the ranking of likely outcomes, but because of cost or other considerations does not develop a full range of possible outcomes to support an expected value estimate. Care should be exercised in preparing an MLV estimate. For example, the MLV is typically not the mid-point between the high and low cost estimates. The MLV should represent a technical and regulatory scenario that is most likely to occur. The MLV may represent a grouping or cluster of scenarios where the cost outcomes are close in magnitude and the combined probability of the grouping or cluster exceeds the probability of other possible scenarios. The MLV is not useful if no scenario, grouping or cluster of outcomes has a probability of occurrence that is significantly greater than others.

5.4.3 *Range of Values*—When an expected value approach is not practical or appropriate, a range of values (without probabilities) may be developed instead. This approach may also be used in addition to the MLV approach to provide additional information, or instead of the MLV approach if probabilities or rankings for various outcomes cannot be determined. The range of values should cover costs from a low cost estimate to a high cost estimate, based on reasonable assumptions. If some outcomes within the range are more probable than others, this standard recommends the additional estimation of a most likely value or an expected value, when possible.

[8] For additional information on the expected value approach, see, for example: R.V. Kolluru, editor, *Environmental Strategies Handbook: A Guide to Effective Policies & Practices*, New York: McGraw-Hill, Inc., 1994 and G.D. Eppen and F.J. Gould, *Quantitative Concepts for Management: Decision Making without Algorithms*, Englewood Cliffs, NJ: Prentice-Hall, Inc., 1979.

5.4.4 *Known Minimum Value*—When the outcome and cost uncertainties are so great that it is premature to estimate a range of values or a most likely value, then a minimum value including component costs (e.g., contracts entered, initial studies) that are reasonably certain to be incurred should be estimated.

5.5 *Contingencies*—Contingency adjustments may be added to correct for costs that are undefined at the time of the estimate, but that are expected to be incurred. Therefore, care should be taken, when adding contingencies to base unit cost estimates, that the contingencies are reasonable and expected to be incurred.[9]

5.6 *Inflation and Discounting*—Inflation and discounting assumptions should be clearly documented.

5.7 *Allocation*—In estimates where *costs and liabilities* for environmental matters involve multiple parties, it may be necessary to apportion these costs among the parties. Determination of an entity's likely allocated share for an event should be made whenever sufficient information is available, and the allocated share should be factored into the cost estimates developed under 5.2. Private parties and courts have employed a variety of methods to allocate or apportion costs (See Appendix X3). As in the case with cost estimation, the method used to allocate costs is dependent upon the amount of information available and the event facts.

5.8 *Uncertainty Associated with Estimation Approaches*—As outlined in 4.2.1, 5.2.1, 5.2.2, and 5.2.3, estimates for *costs and liabilities* for environmental matters are inherently uncertain until resolution of the event matures to the state where all costs are known with certainty. When possible and appropriate, the estimator should quantify or qualify the level of uncertainty associated with the cost and liability estimates. Numerous measures of uncertainty exist. Users of this standard are encouraged to explore the statistical and risk theory literature for such measurements. The best measure of uncertainty for a given application depends on the information available and the facts surrounding the analysis. The estimator should select that measure which most clearly communicates to the user the nature of the uncertainty being evaluated.

5.8.1 *Uncertainty with Expected Value Approach*—Statistical literature provides numerous examples and methods of measuring uncertainty when using an expected value approach. While the expected value approach may not fall neatly into the statistical realm in all cases, the expected value estimate does provide a basis for developing several simple uncertainty measures. Uncertainty measurement is important as it communicates to the user of the estimate the potential amount of variability and/or the level of confidence in the expected value estimate. In some cases, the potential variability will be so great, or the level of confidence so low, that little value should be attached to the expected value estimate. It is important to those relying on expected value estimates prepared under this standard to be aware of such situations. When providing an uncertainty measure with an expected value estimate, the basis and definition of the uncertainty measure should be included. Following are several uncertainty measurements that should be considered in a communication involving an expected value estimate made using this standard.

5.8.1.1 *Confidence Level*—This measure usually involves estimating the percentiles of the probability distribution underlying the expected value estimate. Selection of a 70 % confidence level estimate, for example, would imply that outcomes with values less than or equal to the 70 % confidence level estimate occur 70 % of the time on average, or equivalently, outcomes exceeding the 70 % confidence level estimate occur no more than 30 % of the time on average.

5.8.1.2 *Confidence Interval*—This measure usually assumes a normal distribution around the expected value estimate and estimates the probability of the actual cost or liability being within a given interval of the expected value. Confidence intervals can also be developed for distributions that are not normal.

5.8.1.3 *Coefficient of Variation*—Equal to the standard deviation divided by the mean, the coefficient of variation (CV) provides a basis for evaluating the amount of statistical variation around the expected value estimate. Opinion polls, for example, often state results inclusive of a plus or minus percentage value. A plus or minus percentage value around the expected value could be based on the CV measurement.

5.8.2 *Uncertainty with Most Likely Value (MLV) Approach*—Significant uncertainty may exist in estimates made using the MLV approach. The most likely outcome may not be very likely overall (even though it is the singular most likely outcome in a portfolio of potential outcomes). In addition, MLV analysis provides very little information to quantify the uncertainty. When available, the probability associated with the most likely outcome provides some information concerning related uncertainties. In addition, identification of the range of potential outcomes provides the user of the cost and liability estimate with bounds on the uncertainty associated with the MLV estimate.

5.8.3 *Uncertainty with Range of Values Approach*—To some extent, the size of the range indicates the breadth of uncertainty associated with these cost estimates. For example, if the range is broad, there may be great uncertainty concerning the ultimate cost. When possible, a most likely outcome value should also be provided. When this is not possible, if there are any cost scenarios of clusters or scenarios within the range that are more likely than others, this information should be provided.

5.8.4 *Uncertainty with Known Minimum Value Approach*—For the known minimum value estimate, the upward uncertainty is unknown. If available, a qualitative description of the potential costs or liabilities may allow a user to roughly assess the extent and likelihood of higher values.

5.9 *Recovery/Offsets*—There may be a potential for recovery for, or offsets to, the *costs and liabilities* for environmental matters (e.g., insurance recovery, third-party recovery). Any potential recovery/offsets should be evaluated separately from the original cost and liability estimate, using cost estimation approaches as described in this Section 5. The litigation costs for pursuing such actions also should be estimated separately from these potential recovery/offset estimates.

[9] For additional information on contingencies, see for example F.D. Clark and A.B. Lorenzoni, *Applied Cost Engineering*, NY: Marcel Dekker, 1985, pp. 112-120.

5.10 *Documentation*—Documentation should include the identity of the estimator and a description of their relevant knowledge, training and experience. The estimation documentation should be sufficient for a user to evaluate the estimates. For example, it may be useful to identify the purpose and objective, the estimation approach(es), the major uncertainties considered, and the sources of information used in making estimates of *costs and liabilities* for environmental matters. This documentation may be prepared to cover a single event or multiple events estimated in a similar manner, and may consist solely or in part of existing work papers.

6. Keywords

6.1 cost estimation; environmental; costs; liabilities; expected value; minimum value; most likely value; range of values; uncertainty

APPENDIXES

(Nonmandatory Information)

X1. RELATED DOCUMENTS

E 1369 Standard Guide for Selecting Techniques for Treating Uncertainty and Risk in the Economic Evaluation of Buildings and Building Systems.

E 1528 Practice for Environmental Site Assessments: Transaction Screen Process.

E 1946 Standard Practice for Measuring Cost Risk of Buildings and Building Systems.

American Institute of Certified Public Accountants (AICPA) Statement of Position 96-1, "Environmental Remediation Liabilities," October 10, 1996.

American Institute of Certified Public Accountants (AICPA) Emerging Insurance Task Force (EITF) Abstract 93-5.

EPA Risk Characterization Program: Policy for Risk Characterization, March 1995; Guidance for Risk Characterization, February 1995; Policy for Use of Probabilistic Analysis in Risk Assessment, May 15, 1997; Guidance on Cumulative Risk Assessment, July 3, 1997.

"Filling the GAAP: An Approach to Improve SEC Disclosure of Environmental Liabilities," *Journal of Environmental Law & Practice*, September/October 1994.

Financial Accounting Standards Bulletin (FASB) Interpretation No. 14, "Reasonable Estimation of the Amount of a Loss and Interpretation of FASB-5."

Financial Accounting Standards Board, Rule No. 5, Accounting for Contingencies, March 1975.

The Presidential/Congressional Commission on Risk Assessment and Risk Management, Final Report, 1997, Volume 1: Framework for Environmental Health Risk Management, Volume 2: Risk Assessment and Risk Management in Regulatory Decision-Making.

Security and Exchange Commission (SEC) Staff Accounting Bulletin No. 92.

SEC Regulation S-K.

Security and Exchange Commission (SEC), Management's Discussion and Analysis of Financial Condition and Results of Operations; Certain Investment Company Disclosures, *Federal Register*, Vol. 54, No.99, May 24, 1989.

U.S. Environmental Protection Agency, *Remedial Action Costing Procedures Manual*, EPA/600/8-87/049, 1987.

U.S. Environmental Protection Agency, Office of Pollution Prevention and Toxics, *Valuing Potential Environmental Liabilities for Managerial Decision-Making: A Review of Available Techniques*. EPA/742/R-96/003, December 1996.

X2. EXAMPLE OF EXPECTED VALUE APPROACH

X2.1 This example provides a simplified overview of how to develop an expected value for *costs and liabilities* associated with a group of contaminated sites. The number of uncertainties contributing to the estimate has been deliberately kept to a minimum for the sake of clarity. In practice, the expected value approach can be applied in the same manner to consider many more uncertainties. Similarly, although only soil contamination is considered in this example, the same approach can be applied to include other sources of *costs and liabilities*.

X2.2 At a hypothetical site, soil contamination has been identified by a limited sampling program. The expected value analysis to estimate the costs associated with the contaminated soil is conducted using the five steps defined in 5.4.1.

X2.2.1 *Step 1.* The key uncertaintainties in this event are associated with three parameters: (*1*) the extent of soil contamination, (*2*) the cleanup level to be applied, and (*3*) the treatment/disposal technology for remediation.

X2.2.2 *Step 2.* The decision tree is constructed to reflect these three uncertainties. By convention, the uncertainties are shown as chance nodes by circles (see Fig. X2.1). In the simplified example, each of the uncertainties results in a factor of two difference in the magnitude of the environmental liability.

X2.2.2.1 *Extent of Soil Contamination*—The surface area extent of contamination has been well characterized by shallow soil samples, but the vertical extent is defined only by a very limited number of soil borings. Some of the borings indicate that contamination extends to 1 m in depth and others to 2 m.[10]

X2.2.2.2 *Cleanup Level*—State regulations specify a generic soil cleanup standard for the contaminant of concern, but also allow for determination of a risk-based cleanup goal. A risk-based cleanup goal could be a factor of 10 higher than the generic cleanup standard. Based on the site-specific distribution of contamination at the site, this higher cleanup goal could reduce the contaminated soil volume by a factor of two.

X2.2.2.3 *Treatment/Disposal Technology*—The default approach for the contaminants present at the site would be to excavate and dispose of the soil at an offsite landfill. However, based on the soil conditions and levels of contamination present, a less costly soil venting technology may be feasible.

X2.2.3 *Step 3.* The estimated costs for each potential outcome are determined based on the following assumptions.[11]

X2.2.3.1 Soil volume for deep (2 m) soil contamination

[10] For the purpose of this example, it is assumed that there is a uniform distribution of samples at 1 m and 2 m depths across the site.

[11] These assumptions are given for the purpose of illustration only.

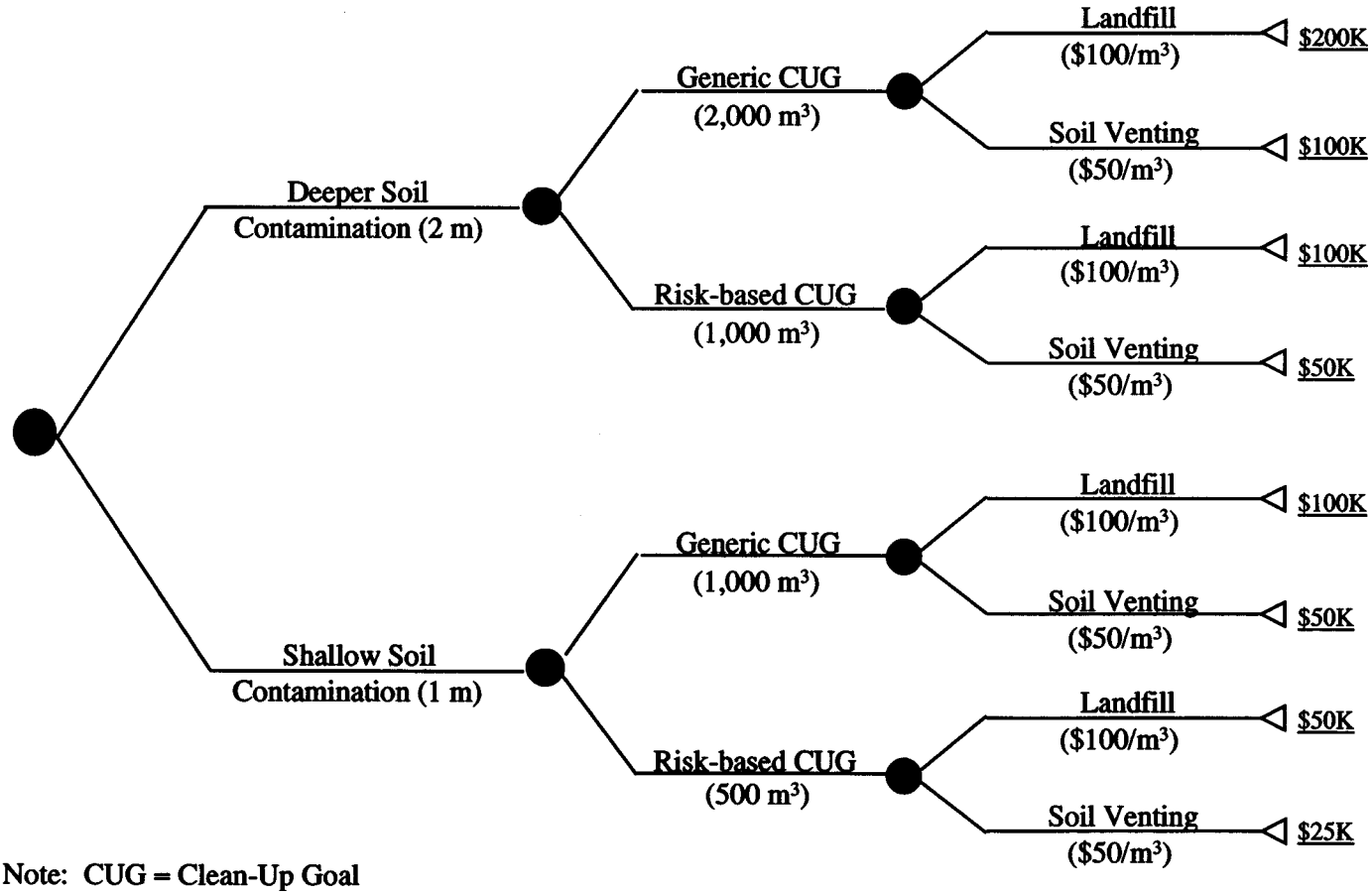

FIG. X2.1 Example Event Tree Uncertainties and Costs

scenario equals 2,000 m^3.

X2.2.3.2 Unit cost for offsite landfill disposal equals \$100 per m^3.

X2.2.3.3 Unit cost for soil venting equals \$50 per m^3.

X2.2.3.4 The costs associated with each potential outcome (represented by a particular path on the decision tree) are shown at the terminal nodes, which are depicted by convention by a triangle as shown in Fig. X2.1. These costs range from a minimum of \$25,000 to a maximum of \$200,000.

X2.2.4 *Step 4.* The likelihood of each outcome is determined as shown in Fig. X2.2.

X2.2.4.1 Approximately half of the soil borings collected at the site show that contamination extends to a depth of 2 m, and the other half show contamination extending to 1 m. Based on this information, a 50 % probability is assigned to each depth scenario.

X2.2.4.2 Historical experience with the relevant state agency suggests a reasonable likelihood that a site-specific risk assessment will be accepted. Accordingly, a 60 % probability is assigned to the higher risk-based cleanup goal, and a 40% probability is assigned to the default generic cleanup goal. (Note that the probabilities must add to 100 %.)

X2.2.4.3 Historical experience with the soil type present at the site and the level of contamination suggests a high likelihood of soil venting being technically feasible. Therefore, a probability of 80 % is assigned to soil venting, and a 20 % probability is assigned to offsite landfill disposal.

X2.2.5 The expected value is then calculated by summing the probability-weighted costs for each pathway on the decision tree. Using the assumed probabilities and unit cost data, the expected value is calculated at \$63,000 (See calculation in Fig. X2.2). The probability of each individual outcome, as represented by a pathway on the decision tree, is calculated by multiplying the probabilities along that pathway. Thus, the maximum cost of \$200,000 has a 4 % likelihood (50 % × 40 % × 20 %) and the minimum cost of \$25,000 has a 24 % likelihood (50 % × 60 % × 80 %). The most likely outcome of \$50,000 has a probability of 46 % (by summing the three \$50,000 outcomes with probabilities of 24 %, 16 %, and 6 %).

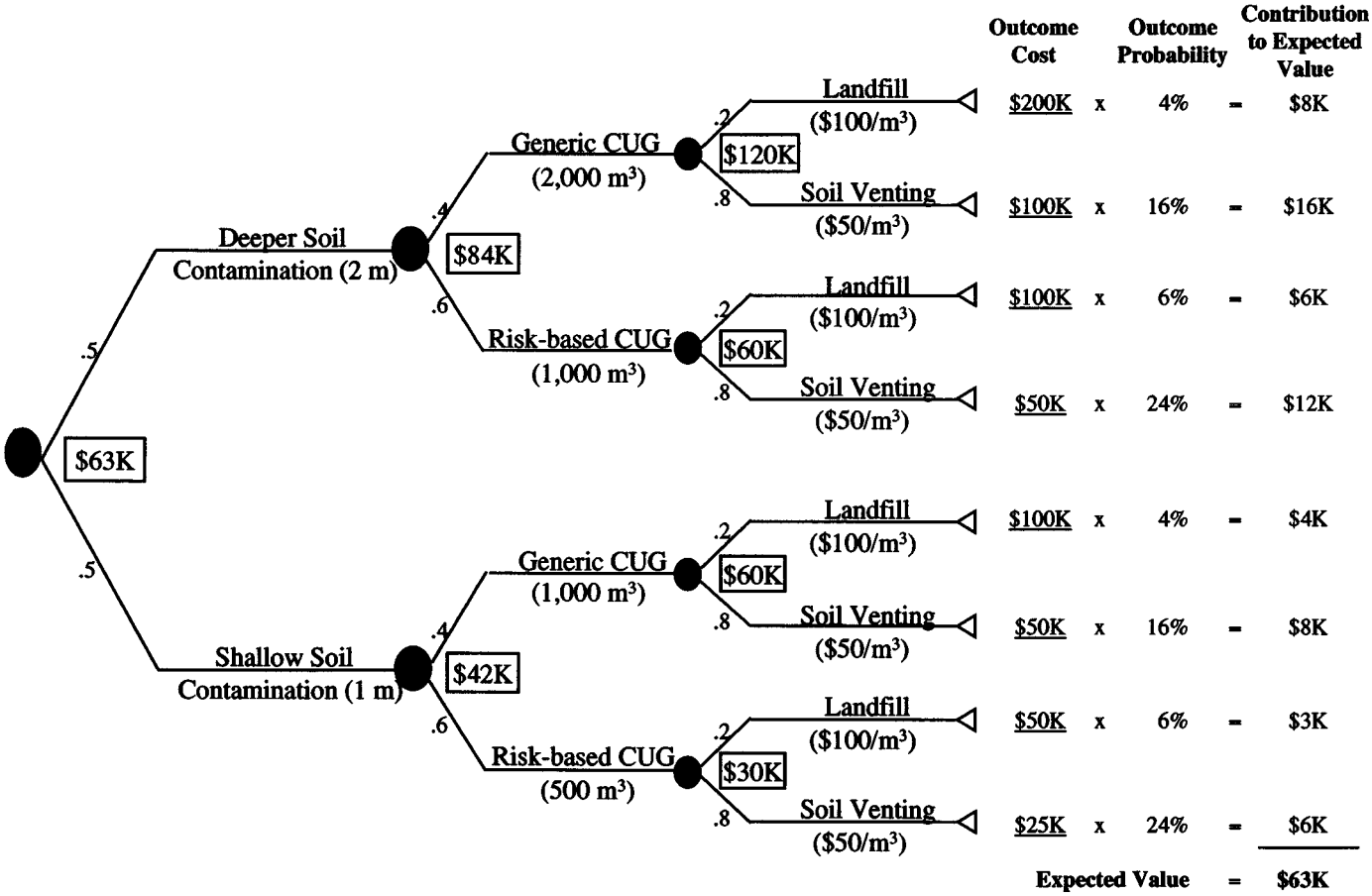

FIG. X2.2 Example Event Tree Expected Value

X3. POTENTIAL ALLOCATION CONSIDERATIONS

X3.1 The courts, PRP groups, and other parties have considered numerous issues in deriving allocations for CERCLA and non-CERCLA events. CERCLA states that "[In] resolving contribution claims, the court may allocate response costs among the liable parties using such equitable factors as the court determines are appropriate." Having pointed to "equitable factors," CERCLA is then silent as to what those factors might be. Factors that may be considered include, but are not limited to:

X3.1.1 The ability of the parties to demonstrate that their contribution to a discharge, release or disposal of a hazardous waste can be distinguished;

X3.1.2 The amount of the hazardous waste involved;

X3.1.3 The degree of toxicity of the hazardous waste involved;

X3.1.4 The degree of involvement by the parties in the generation, transportation, treatment, storage or disposal of the hazardous waste;

X3.1.5 The degree of care exercised by the parties with respect to the hazardous waste concerned, taking into account the characteristics of such hazardous waste; and

X3.1.6 The degree of cooperation by the parties with federal, state, or local officials to prevent any harm to the public health or the environment.

X3.1.7 Existing contracts between parties on the question of liability, such as indemnity agreements;

X3.1.8 Relative fault of the parties (e.g., cost causation, stand-alone costs);

X3.1.9 The owner's acquiescence in the operator's activities and manner of operation;

X3.1.10 The degree to which each party made efforts to prevent and/or contain any known release of hazardous wastes at the site, at the time the releases occurred;

X3.1.11 Relative economic benefits across the classes of PRPs; and

X3.1.12 Benefit to the current owner, if any, of the cleanup.

X3.2 If it is possible that other PRPs will not pay their full share, adjustments may be included to reallocate such orphan shares.

EXHIBIT C

- Roux relied on 2008 and 2010 screening reports for the Lukachukai mine area, asserting that such information was knowable based on its site visit observation that waste rock piles were visible three or more years after the IPO.
- For the Soda Springs site, Roux used 2007 and 2009 documents to justify additional groundwater studies, whereas the record in 2005 indicated the groundwater remedy was functioning adequately and as intended.
- For the Jericho site, Roux used 2007 and 2009 settlement negotiation information to estimate costs.
- For the Columbus site, Roux used multiple documents from 2008 to 2010 to estimate the scope of and to justify the need for remedy elements.
- At service stations, Roux cited several documents from 2007 to 2009 to estimate and calculate remaining costs at 10 service stations under active remediation.
- For the Henderson site, Roux used a 2011 document to support its "Mega Site" classification of that site.
- For the Madison site, Roux added work based on a 2009 report, and made similar additions for the Texarkana site based on a 2009 report and 2010 Tronox correspondence.

Many other examples exist and are presented in our site-specific critiques of the Roux Report analyses contained in **Appendix E** and **Appendix F**.[15]

3.2.2 Deterministic *vs.* Probabilistic Approach

Probabilistic cost analysis is generally accepted as the preferred method for estimating future environmental costs.[16] In probabilistic cost analysis, several possible activities are evaluated, then each activity is assigned a probability of occurrence and analyzed statistically (*i.e.,* "modeled") to arrive at an

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[15] Our analyses of Schedule 2.5(a) sites and categories is provided in **Appendix E** and our analyses of Non-Schedule 2.5(a) sites and categories is provided in **Appendix F**.

[16] The ASTM guidance identifies "Expected Value" from probabilistic cost analysis as the most robust and comprehensive method for estimating future environmental liabilities and costs, except for contractor bids, and identifies the Most Likely Value (MLV) approach as specifically less robust and comprehensive. See ASTM International. 2006. Standard Guide for Estimating Monetary Costs and Liabilities for Environmental Matters. GNARUS00027389 - GNARUS00027399; at page GNARUS00027392.

Additionally, we note that all of the experts (including Mr. White) for key parties in the Asarco Bankruptcy – ASARCO, LLC (the debtor), ASARCO, Inc. and the experts for the U.S. Government (and states where applicable) employed the probabilistic cost analysis methodology to evaluate future environmental liabilities. ASARCO is generally viewed as one of the largest, if not the largest, environmental bankruptcy cases in U.S. history. (*In Re Asarco LLC.*, Case No, 05-21207, Bnkr.Ct. S.D. Texas (Corpus Christi)).

3.2.3 Wrong Discount Rate

In calculating the NPV of future costs, Roux employed a real discount rate (*i.e.*, a rate net of inflation) of **2.5%**,[18] which was provided in the Newton Report.[19] The **2.5%** rate approximated a real "risk-free" discount rate as of late 2005. As explained in greater detail in **Appendix I**, a risk-free discount rate — the rate of interest on investments traditionally deemed to be highly certain and thus safe (*e.g.*, US government treasuries) — is inappropriate for calculating the NPV of environmental costs borne by private parties (such as Tronox) because future environmental costs are not certain or risk-free. As further elaborated in **Appendix I**, in light of our economic analysis and a review of 75 different RODs that USEPA issued between 2003 and 2005, we believe a **5.0%** real discount rate should be used. Those RODs covered many types of sites, not just Kerr-McGee sites, and showed a real discount rate range of **3%** to **8%**.

3.2.4 Flawed "Metric" Approach

A large portion of Roux's cost estimates were based on a portfolio methodology, which the Roux Report refers to as "metrics." A portfolio methodology is a benchmarking method whereby a set of aggregate data from one group of sites is used to forecast costs at other specific sites. While the general principle is not unsound, Roux's application was computationally incorrect. The estimates used in the Roux Report are upwardly biased for many of the sites analyzed by this method.

The Roux Report used NPV results as the benchmark for forecasting response costs at sites evaluated in its metrics methodology, but many of the response costs at sites used as benchmarks included past costs — whereas the response costs at sites to be forecast under the metrics methodology are exclusively future costs. Use of the NPV (which is merely a timing adjustment to a cash flow) as opposed to using the cash flow itself, creates a biased result.

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[18] See Roux Report at RAM-000083 ("Roux Associates then applied a 2.5% discount to each of the lower-end cost elements (**Table 3-2a)** as well as to the higher-end cost elements **(Table 3-2b)** to calculate present values of the cost elements for each site."), and ("The discount rate and formula were provided to Roux Associates by the Anadarko Litigation Trust's solvency expert, Professor Grant W. Newton.")

[19] See Newton Report, Appendix D. Note that despite Newton's description of his 2.5% discount rate, his data confirms that it is essentially a risk-free rate.